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# Terms of Reference

# Feasibility Study of Energy Efficiency and Implementation Measures in Public Buildings

## Background

*<Economic situation in the country, electricity supply and generation, rationale for the project, institutional and regulatory framework in the country.>*

## Objective

The purpose of this assignment is to assess the EE potential in central government facilities in the [country] and develop baseline energy assessments to support these investments. These energy assessments would then be converted under the donor-financed [project name] into detailed designs and bidding documents and implemented. Such efforts will help the Government fulfill its obligations based on the [EE law] and the [regulations on energy auditing], while contributing to [country]’s EE targets under their National Energy Efficiency Action Plan (NEEAP) as required under the [energy law].

## Scope of Services

*< EE situation in public buildings.>*

The Consultant will be required to prepare baseline energy assessments (detailed energy audits) for [number] central government buildings for financing under the upcoming [donor] credit. The preparation of the baseline energy assessments will be done in three phases. In this regard, the Consultant will be responsible for the following tasks:

### Task 1 – Review background information, update national public building stock study and agree on methodology

The Consultant shall review relevant background information and market studies, existing energy audit reports in central facilities, energy consumption data provided by the government agencies, and develop a work plan for review and approval by the [EE agency] and the [donor]. The plan should include the proposed methodology for determining the baseline consumption and conducting of the baseline energy assessments (e.g., frequency and duration of metering as needed, number of years of baseline energy use, payback cut-off period for EE measures). Issues related to current service levels as compared with national norms (i.e., over and underheating), on-site heat vs. district heating (DH), etc. should be included.

In addition, the Consultant shall update the latest national building stock study to confirm the number of government buildings, both central and municipal, and provide basic information related to their operations – i.e., size, age, function, energy use and costs, fuel type, etc. the Consultant will need to use multiple channels to get the most accurate accounting of buildings and their energy use, including existing reports, ministerial and municipal interviews, surveys and site inspections. In addition, the Consultants should investigate and quantify the presence and estimate of the amount of hazardous materials (i.e. asbestos and mercury from lighting) in those buildings that are identified in the ownership of the central government, so the government can better plan for their eventual renovation under [project name].

Output

A work plan that includes proposed methodology for determining the baseline consumption and conducting of the baseline energy assessments. An updated national buildings stock report will be submitted to [EE agency] and the [donor] team for review and comment, and finalized once revisions have been accepted. A final report of the updated national public building stock study would be disseminated though a final workshop, to be organized by the Consultant in coordination with [EE agency], with relevant stakeholders, including the [ministries in charge of finance and economic development], [EE agency], line ministries, relevant donors, municipalities, technical experts and other stakeholders.

### Task 2 – Completion of baseline energy assessments and revisions of existing audit reports

The [EE agency] will coordinate with the Consultant and relevant government agencies to obtain copies of invoices and bills of energy (electricity, heat, fuel) consumption for the past three years in timely fashion. Additional information on existing service/comfort levels, number of heating days, past EE renovations, should also be provided as available. [EE agency] will also coordinate with the agencies to ensure they provide full access to their facilities for the assessments to be conducted.

The Consultant will then conduct site visits to complete baseline energy assessments (i.e., detailed energy audits) for all central buildings without existing audit reports. This will include, inter alia, collecting baseline information on the facility (building description and function, age, heated area, drawings, equipment inventory) as well as analyses on existing building envelope, heating systems, and other energy-using systems (e.g., indoor/outdoor lighting, cooling and ventilation, cooking, etc.). The analysis should also take into account buildings connected to the district heating networks, fuel pricing, planned closures/expansions, etc. The baseline energy assessment reports will also specifically analyze the potential for implementation of solar water heating systems in selected buildings where there is a significant use of hot water. (Annex 1 contains a suggested outline for these assessment reports.)

The Consultant will then prepare baseline energy assessment reports, which shall include:

* On-site inspections
* Review of available documentation (e.g., drawings of boiler plant, heating installation, building plans, energy bills, etc.)
* Building state description and identified measures
* Interviews with facility managers/engineers
* Energy calculations
* Economic calculations

Based on analysis, the baseline energy assessment report will propose technically-viable EE measures, calculate energy savings (both based on achievement of heating norms as well as expected actual energy savings), investment costs, payback times and net present value (10% discount rate), environmental benefits, along with implementation plans, operations and maintenance (O&M) and training requirements, and energy monitoring. Possible EE and renovation measures should include, but not be limited to, building envelope measures (e.g., windows, wall/floor/roof insulation and repair, doors), efficient heating (water and space) systems, heat meters and controls (for those with DH connections), fuel switching (including to renewable energy such as solar water heating, biomass, ground-source heat pumps), cooling and ventilation systems, fans and pumps, lighting system (indoor and outdoor), and improved O&M practices. For buildings within reach of the DH network in [city], the feasibility of a DH connection should be actively explored.

The baseline energy assessments should also include detailed identification and estimate of quantity of potentially hazardous materials (asbestos, mercury from lighting, possibility of lead based-paint) in the buildings as well as propose mitigation measures for the proper disposal according to the local laws and regulations, [international directives] and [donor] requirements. These mitigation measures will in any case consist of:

1. provide information on good international practice and requirements regarding removal and handling of asbestos and
2. provide information on good international practice and requirements regarding removal, handing packaging, collection and treatment options for mercury containing CFLs;
3. typical cost (incremental) costs of proper handling, storage and treatment of hazardous materials; and
4. provide information on international practices regarding provision of information, training and licensing requirements for the safe removal and handling of the hazardous materials mentioned above. The [ministry in charge of environment and spatial planning] is working towards the establishment of and (interim) storage facility for hazardous materials and consultants should liaise with the [ministry in charge of environment and spatial planning] regarding final disposal and treatment options, licensing requirements and applicable local regulations on this issue.

For facilities with existing energy audit reports, no baseline energy assessments will be required. However, these reports must be evaluated, any deficiencies identified, and additional data collected to upgrade them into complete and up-to-date reports.

It will also be necessary for this task to be phased, in order for early assessments to be reviewed and deficiencies identified so the subsequent batch of reports is of improved quality. It is also important for the reports to be current at the time the detailed designs and bidding documents are developed. Therefore, it is expected that [number] reports would be completed in Year 1 and [number] in each of the subsequent years in line with the proposed implementation schedule of the investment project.

Output

Baseline energy assessment reports and report revisions for buildings with existing audit reports. The first [number] assessment reports will be submitted to the [EE agency] and the [donor] team for review before additional ones are prepared to ensure the approach, level of detail and quality is agreed on both sides. Once approved, the rest will be completed and submitted for approval as completed. The Consultant will agree with the [EE agency] and the [donor] on sequencing of the assessments and logical batching of audits, either by ministry, geography, building type or a combination of these.

## LANGUAGE OF DOCUMENTS

All deliverables should be prepared and submitted in [languages]. The baseline energy audit reports should be in both [languages] so the relevant government agencies can review them.

## EXPERIENCE AND QUALIFICATIONS OF THE CONSULTANT

The Consultant should be a consulting firm with relevant project experience, both technical and regional. Relevant technical experience would include programs related to EE renovations in buildings—e.g., conducting of energy audits in buildings, energy auditor training, design and implementation of building EE programs, EE market assessments in the building sector, building stock studies, etc. The work should be undertaken by a consulting team, or consortium, consisting of experts who have following skills and credentials:

* Education of at least bachelor’s degree in Engineering and Economics
* Strong knowledge of local standards and norms
* Professional experience in the field of this project
* Prior experience on energy auditing of buildings and preparation of detailed project designs
* Engineer’s authorizations for design preparation and supervision of construction works on municipal buildings in compliance with local legal requirements
* Good communication, management, organization and reporting skills

The exact composition of the team will be left to each firm to propose, but key expertise and specialists are expected to include:

### Key expert 1: Project Manager, Energy Efficiency Specialist with specific project management experience of 10+ years in EE assessments, energy audits, EE in buildings.

The expert has been project manager of at least five related feasibility studies, EE assessments and energy audits of buildings. The expert has a university degree in engineering, energy economics or similar and solid experience in the development of feasibility study assessments of EE measures in buildings and performance of energy audits. Experience in the [country] and/or [region] is required.

### Key expert 2: Deputy Project Manager and EE Design Engineer.

Design/costing engineer with at least 7 years of experience. University degree in civil engineering or equivalent. Detailed and long term experience in [country] in the field of building construction design and renovation, standards and permit requirements for commercial and public building renovations in accordance with legislation in [country] and detailed experience with costing. Fluency in [language] required.

### Key expert 3: Energy Audit and Monitoring Specialist.

The expert has a university degree in energy, engineering or similar with 10+ years international professional experience in the development of energy auditing, developing energy baselines, assessing EE measures, EE project commissioning, EE in buildings, etc. Experience in the region is an advantage.

### Key expert 4: Energy economist.

The expert has a university degree in environmental or energy economics or similar and at least 5 years of experience in preparation of feasibility study analysis, cash flow analysis, IRR/NPV/payback calculations of a variety of EE measures in building environments.

### Key expert 5: Environmental Engineer.

University degree in environmental engineering or equivalent with at least 5 years of experience in hazardous material inventories in buildings, in particular asbestos and experience with international requirements for proper asbestos and mercury containing CFLs removal, handling and possible treatment options, including costs. Knowledge of [international directives], international best practices, and development of simplified, low-cost options for developing countries required.

In order to comply with local legal requirements, the consulting firm together with local partners should hold relevant firm’s licenses for preparation of design of works for renovation. In order to build local capacity and manage costs, a substantial portion of the energy audits are expected to be conducted by local experts under the supervision of international specialists. Therefore, the international team should include a plan for working alongside local partners to conduct the initial audits and develop a consistent approach and methodology for the remaining ones, while ensuring quality control. The proposed methodology, team and share of Level Of Effort (LOE) between international and local experts must reflect this.

## TIMETABLE

The work plan (Task 1) should be submitted, as part of the Inception Report, 3 weeks after the contract signature.

The first [number] baseline energy assessment reports (Task 2) will be submitted for review 2 months after contract signature. Once approved, the full set of [number] energy audit reports for Year 1, along with a summary of deficiencies and remedies to existing energy audit reports will be submitted 6 months after contract signature. For years 2 and 3, all [number] audit reports should be made available 12 months and 24 months after contract signature. The national building stock study should be submitted 9 months after contract signature.

## LEVEL OF EFFORT

The level of effort for this assignment is estimated to be about 1,800 person-days, with about 80% expected from local consultants.

## Annex 1 - Draft Baseline Energy Assessment Report Outline

The draft baseline energy assessment report shall include the following chapters, plus annexes:

1. Summary
2. Introduction
3. Project Organization

An overview of names, addresses, phone and e-mail of involved institutions/ municipalities.

1. Standards and Regulations: A short overview of Standards and Regulations relevant for energy efficiency and renovation interventions.
2. Building State Description:

* Description of the existing situation of the building, technical systems and operation pattern;
* General conditions (indoor environment, operation and maintenance, service agreements, energy meters, energy monitoring system, cleaning routines);
* Building envelope (external wall, windows, roof, heated area, floor above unheated area, basement, visible thermal bridges, visible damages, external areas with heat losses, etc.);
* Heating system (energy consumption, heating system, automatic control);
* Other technical systems (fans and pumps, lighting system and electrical installation, various equipment, outdoor).

1. Energy Consumption: Three years energy consumption plus Energy Budget before and after energy efficiency (EE) and renovation measures.
2. EE Potential: The EE Potential table with additional comments including energy and cost savings, investment, payback and profitability.
3. EE Measures: A detailed description for each EE measure: existing situation, proposed measures, energy savings and investment costs.
4. Environmental aspects: Calculation of carbon emissions and local air pollution reduction potential. Quantification of potentially hazardous materials that would require proper disposal.
5. Implementation: Proposal for how to organize the project implementation with corresponding time-schedule.
6. Operation and Maintenance: Description of proposed O&M routines and user patterns, including training of O&M personnel.
7. Energy Monitoring: Description of proposed energy monitoring procedures.
8. Annexes (e.g., project plans)